Instructions–Parts List

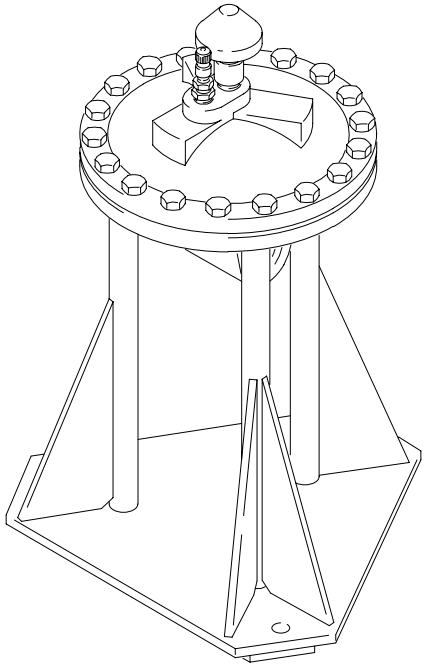
HIGH–FLO® SERIES
Surge Tanks

307707ZAP

ENG

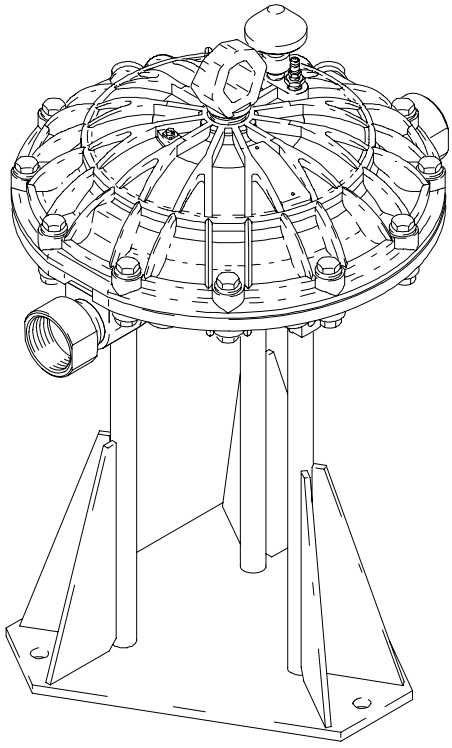
These tanks reduce fluid surging in a high– or medium–volume, low–pressure fluid system. For professional use only.

Important Safety Instructions
Read all warnings and instructions in this manual.
Save these instructions.



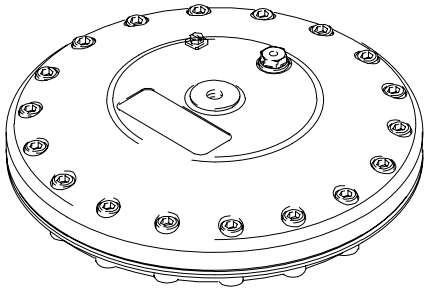
Model 220157, Series E
on Surge Tank Stand Kit 218742

7139A



Model 238983, Series C
on Surge Tank Stand Kit 218742

7287B



Model 233736, Series A

TI1898B

PROVEN QUALITY. LEADING TECHNOLOGY.

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List of Models

Part No.	Series	Description	Maximum Fluid Working Pressure
238983, 238986	C	High volume, electropolished stainless steel, 2 npt(f) inlet and outlet	300 psi (2.1 MPa, 21 bar)
238984, 238987	C	High volume, electropolished stainless steel, 2 in. sanitary inlet and outlet (Tri–Clamp® compatible)	300 psi (2.1 MPa, 21 bar)
238985, 238988	C	High volume, electropolished stainless steel, 1.5 in. sanitary inlet and outlet (Tri–Clamp® compatible)	300 psi (2.1 MPa, 21 bar)
233736	A	High volume, stainless steel, 1/4 bspp(f) air port, 3/4 bspp(f) fluid port	360 psi (2.5 MPa, 25 bar)
218509	E	High volume, carbon steel, 2 npt(f) inlet and outlet	600 psi (4.2 MPa, 42 bar)
220157	E	Medium volume, electropolished stainless steel, 1.25 npt(f) inlet, 1.25 npt(f) outlet	600 psi (4.2 MPa, 42 bar)
Accessory			
218742	A	Surge Tank Stand Kit (not used with Part No. 233736)	n/a

Symbols

Warning Symbol

⚠ WARNING

This symbol alerts you to the possibility of serious injury or death if you do not follow the instructions.

Caution Symbol

⚠ CAUTION

This symbol alerts you to the possibility of damage to or destruction of equipment if you do not follow the instructions.

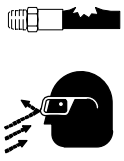
⚠ WARNING

INSTRUCTIONS

EQUIPMENT MISUSE HAZARD

Equipment misuse can cause the equipment to rupture or malfunction and result in serious injury.

- This equipment is for professional use only.
- Read all instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are not sure, call your Graco distributor.
- Do not alter or modify this equipment. Use only genuine Graco parts and accessories.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure of the lowest rated component in your system. See **Technical Data** on page 23.
- Use fluids and solvents that are compatible with the equipment wetted parts. Refer to the **Technical Data** section of all equipment manuals. Read the fluid and solvent manufacturer's warnings.
- Route hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 82°C (180°F) or below –40°C (–40°F).
- Wear hearing protection when operating this equipment.
- Do not lift pressurized equipment.
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.



PRESSURIZED EQUIPMENT HAZARD

Spray from the gun, hose leaks or ruptured components can splash fluid in the eyes or on the skin and cause serious injury.

- Do not stop or deflect fluid leaks with your hand, body, glove or rag.
- Follow the **Pressure Relief Procedure** on page 9 when: you are instructed to relieve pressure; stop spraying; clean, check or service the equipment; and install or clean fluid nozzles.
- Do not point the spray gun at anyone or at any part of the body.
- Tighten all fluid connections before operating the equipment.
- Check the hoses, tubes and couplings daily. Replace worn, damaged or loose parts immediately. Permanently coupled hoses cannot be repaired; replace the entire hose.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Improper grounding, poor ventilation, open flames or sparks can cause a hazardous condition and result in a fire or explosion and serious injury.

- Ground the equipment. See **Grounding** on page 5.
- If there is any static sparking or you feel an electric shock while using this equipment, **stop pumping immediately.** Do not use the equipment until you identify and correct the problem.
- Provide fresh air ventilation to avoid the buildup of flammable fumes from solvents or the fluid being pumped.
- Keep the work area free of debris, including solvent, rags, and gasoline.
- Electrically disconnect all equipment in the work area.
- Extinguish all open flames or pilot lights in the work area.
- Do not smoke in the work area.
- Do not turn on or off any light switch in the work area while operating or if fumes are present.
- Do not operate a gasoline engine in the work area.
- Never use 1.1.1–trichloroethane, methylene chloride, other halogenated hydrocarbon solvents or fluids containing such solvents in pressurized aluminum equipment. Such use could result in a chemical reaction, with the possibility of explosion.

TOXIC FLUID HAZARD

Hazardous fluid or toxic fumes can cause serious injury or death if splashed in the eyes or on the skin, inhaled, or swallowed.

- Know the specific hazards of the fluid you are using.
- Store hazardous fluid in an approved container. Dispose of hazardous fluid according to all local, state and national guidelines.
- Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.
- Graco does not manufacture or supply the reactive chemical components that may be used in this equipment and is not responsible for injury or property loss, damage, expense or claims (direct or consequential) that arise from the use of such chemical components.

MOVING PARTS HAZARD

Moving parts, such as the air motor piston in the pump, can pinch or amputate your fingers.

- Keep clear of all moving parts when starting or operating the pump.
- Before servicing this surge tank, follow the **Pressure Relief Procedure** on page 9 to prevent the equipment from starting accidentally.

Installation

All Models

Grounding

Ground the tank and the rest of your system. See **Fire and Explosion Hazard** on page 4.

Static electricity is generated by the flow of fluid through the pump and hose, but it is dissipated through proper grounding. If every part of the spray system is not properly grounded, sparking may occur, and the system may become hazardous. Sparking may also occur when plugging in or unplugging a power supply cord. Sparks can ignite fumes from solvents and the fluid being sprayed, dust particles and other flammable substances, and can cause a fire or explosion and serious injury and property damage.

If you experience any static sparking or feel even a slight shock while using this equipment, **stop spraying immediately**. Check for proper grounding of the entire system. Be sure you have corrected the problem before starting to spray again.

Ground the pump and all other spray equipment used or located in the spray area. The following are minimum requirements for grounding a basic spray system. Your system may include other equipment or objects which must also be grounded. Always check your local electrical code for detailed grounding instructions. Be sure your system is connected to a true earth ground.

- *Pump:* Ground by using a ground wire and clamp as described in your separate pump instruction manual.
- *Air compressors and hydraulic power supplies:* Follow the manufacturer's recommendations.
- *All air and fluid lines:* Use only grounded hoses with a maximum of 150 m (500 ft) combined hose length to ensure grounding continuity. See **Hose Grounding Continuity** on page 5.
- *Surge tank:* Connect a ground wire and clamp as shown in Fig. 1. Loosen the grounding screw (W). Insert one end of a 1.5 mm^2 (12 ga.) minimum ground wire (Y) behind the grounding screw and tighten the screw securely. Connect the clamp end of the ground wire to a true earth ground. Order Part No. 222011 Ground Wire and Clamp.
- *Spray gun:* Obtain grounding through connection to a properly grounded fluid hose and pump.
- *Object being sprayed:* Ground according to local code.
- *Fluid supply container:* Ground according to local code.
- *All solvent pails used when flushing* must be grounded according to local code. Use only grounded metal pails, which are conductive. Do not place the pail on any non-conductive surface, such as cardboard or paper, which would interrupt grounding continuity.
- *To maintain grounding continuity when flushing or relieving pressure,* always hold a metal part of the gun firmly to the side of a grounded metal pail, then trigger the gun.

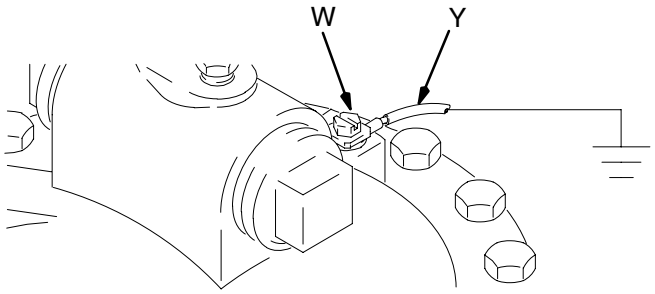


Fig. 1

Hose Grounding Continuity

Proper hose grounding continuity is essential to maintaining a grounded spray system. Check the electrical resistance of your air and fluid hoses at least once a week. If your hose does not have a tag on it which specifies the maximum electrical resistance, contact the hose supplier or manufacturer for the maximum resistance limits. Use a resistance meter in the appropriate range for your hose to check the resistance. If the resistance exceeds the recommended limits, replace the hose immediately. An ungrounded or poorly grounded hose can make your system hazardous.

Flushing Safety

Before flushing, be sure the entire system and flushing pails are properly grounded, and be sure that pressure is relieved. See **Grounding** and **Pressure Relief Procedure** on page 9.

Installation

Models 238983, 238984, 238985, 238986, 238987, 238988, 218509, and 220157

NOTE: Refer to page 8 to install Model 233736.

Installing the Tank

Use Stand Kit 218742 to mount the tank to the floor. See the **Stand Mounting Hole Layout** on page 22. Secure the stand (B) to the floor with M19 (5/8 in.) bolts that engage at least 152 mm (6 in.) into the concrete floor to prevent the tank from tipping.

Horizontal / Vertical Mounting

All surge tanks can by mounted horizontally or vertically.

NOTE: Model 220157 can be mounted vertically with the fluid direction flowing upward (with the fluid inlet at the bottom).

Stand Kit

(See Fig. 2.)

Items J, K, and L (mentioned in the text below) are supplied with Stand Kit 218742.

Secure the bracket (J) to the leg of the stand (B) with a screw (K). Notice the different bracket positions for the three tank sizes.

Turn the bracket (J) with a wrench to align it with the bosses on the surge tank. Then secure the bracket to the tank with the screws (L).

Fluid Inlet / Outlet Ports

On high-volume models (218509, 238983, 238984, 238985, 238986, 238987, and 238988), either port may be used as the fluid inlet. The direction of fluid flow through these models does not affect the performance. See the **Dimensional Drawings** on page 21.

⚠ CAUTION

The inlet and outlet adapter fittings on Models 238983, 238984, and 238985 (Ref. No. 3 on page 20) use a non-standard thread to fit into the fluid cover (Ref. No. 1 on page 20). You must use Graco-approved fittings to prevent thread damage. Contact your Graco distributor for optional fittings.

Fluid Lines and Accessories

(See Fig. 3.)

Install a fluid drain valve (H) near the surge tank outlet.

⚠ WARNING

A fluid drain valve (H) is required in your system to help reduce the risk of serious injury, including splashing fluid in the eyes or on the skin and injury from moving parts.

Opening the fluid drain valve helps relieve pressure in the surge tank, pumps, hose and gun after shutting off the system. Triggering the gun to relieve pressure may not be sufficient.

Install a fluid shutoff valve (C) before and after the surge tank to isolate it when servicing the tank. See Fig. 3.

Proper line sizing is an important part of the system. Contact your Graco distributor if you need assistance. To obtain proper flow through the system, use the proper size plumbing from the following list:

- *Models 238983, 238984, 238985, 238986, 238987, 238988:* Use a minimum 51 mm (2 in.) diameter pipe and plumbing.
- *Model 218509:* Use a minimum 51 mm (2 in.) diameter pipe and plumbing.
- *Model 220157:* Use a minimum 25 mm (1 in.) diameter flexible hose between the pump and tank and a hard or flexible pipe after the tank.

Installation

Models 238983, 238984, 238985, 238986, 238987, 238988, 218509, and 220157

Stand Kit

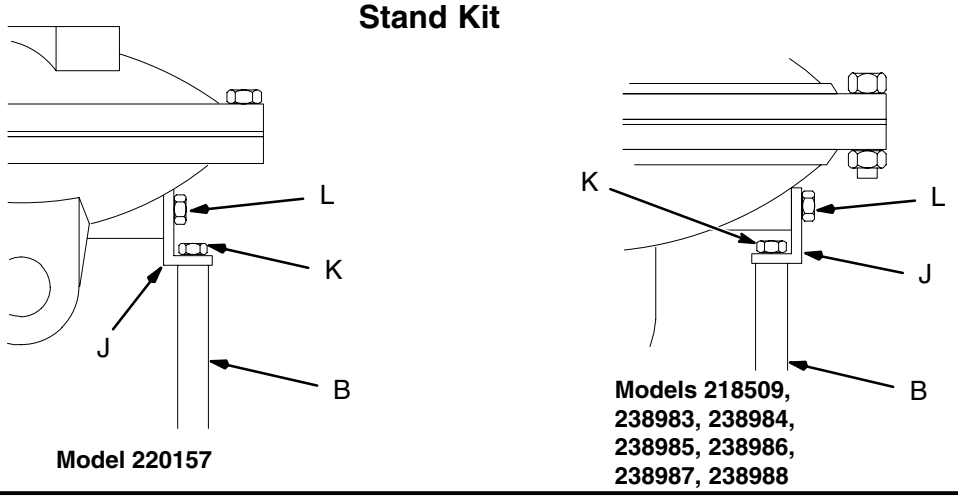


Fig. 2

Typical Installation

KEY

A Surge tank
B Stand
C Fluid shutoff valve
D Fluid line
E Mix tank
F High-Flo pump
G Ground wire*
H Fluid drain valve*
J Bleed-type master air valve*

* Required for safe operation. Must be purchase separately.

NOTE: This installation is only a guide for selecting and installing a system; it is not an actual system design. Contact your Graco distributor for assistance in designing a system to suit your needs.

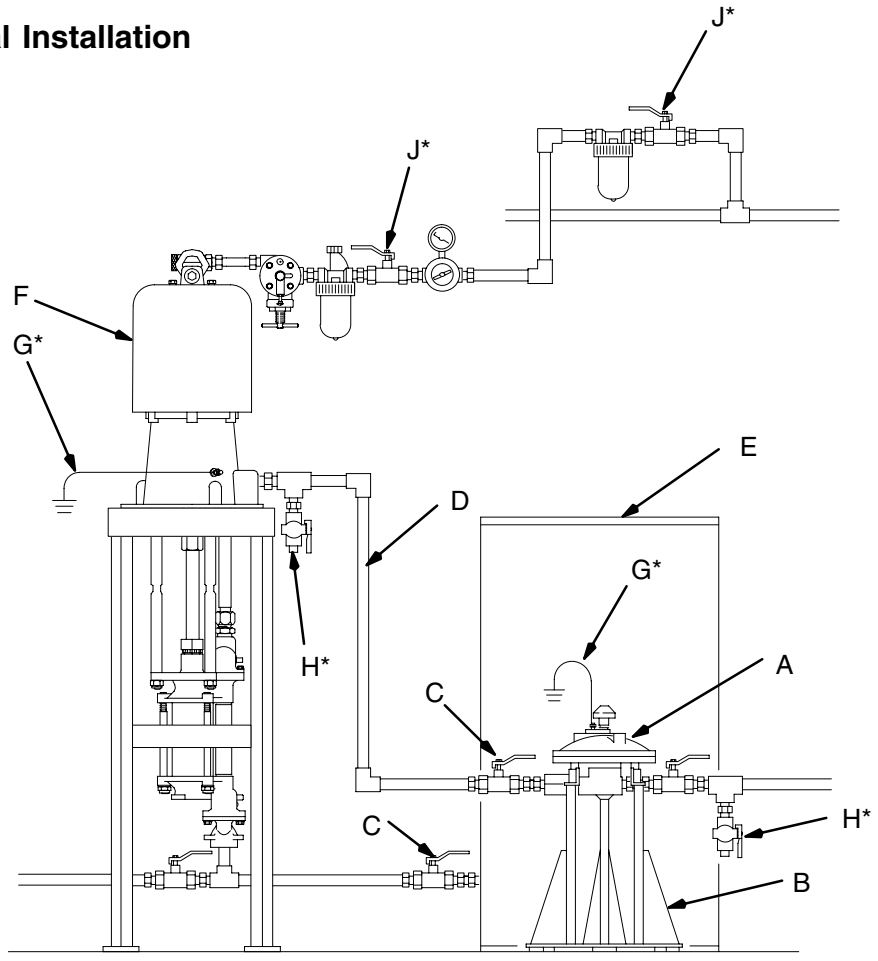


Fig. 3

Installation

Model 233736

Model 233736 surge tank (A) must be installed horizontally (see Fig. 4).

Install the surge tank on a short riser tube (B) off the fluid supply line (D). The air inlet must face up.

Install an air pressure regulator (M) and a ball valve (N) on the air supply line (P) to the surge tank. The air regulator controls the air pressure in the tank. The ball valve prevents air from escaping from the tank during operation.

Install a fluid valve (T) on the riser tube (B). Close this valve to allow maintenance of the surge tank while fluid continues to flow in the main fluid supply line.

Remove the plug (12) and install a fluid priming valve (R) and drain line (S), for use in bleeding air from the fluid section.

Typical Installation

KEY

A Surge tank
B Riser tube
C Fluid shutoff valve
D Fluid line
E Mix tank
F High-Flo pump
G Ground wire*
H Fluid drain valve*
J Bleed-type master air valve*
M Air regulator
N Air shutoff valve
P Air line to surge tank
R Priming valve
S Fluid drain line
T Fluid valve
U Pump air regulator

* Required for safe operation. Must be purchased separately.

NOTE: This installation is only a guide for selecting and installing a system; it is not an actual system design. Contact your Graco distributor for assistance in designing a system to suit your needs.

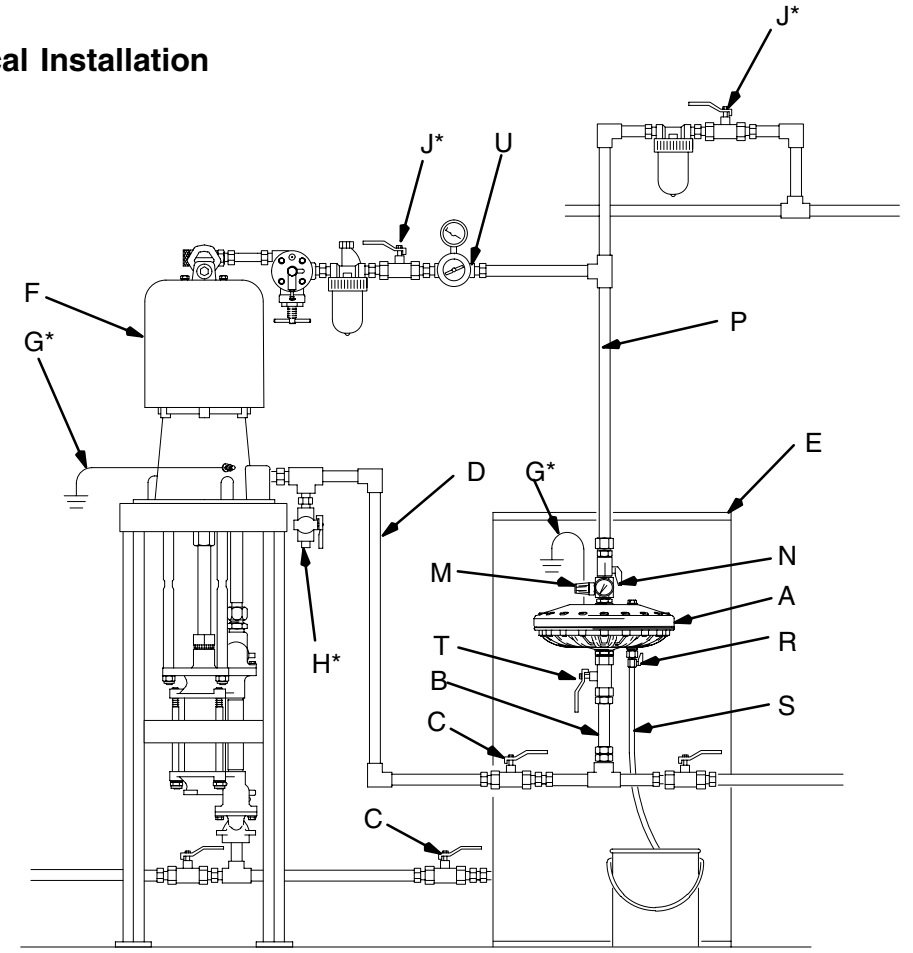


Fig. 4

Operation

All Models

Pressure Relief Procedure

⚠ WARNING

To reduce the risk of an injury from splashing fluid or moving parts, follow the **Pressure Relief Procedure** whenever you

- Are instructed to relieve the pressure
- Stop dispensing
- Check or service any of the system equipment
- Install or clean any system components

1. Turn off the power to the pump.
2. In a hydraulic system, close the hydraulic shutoff valves.
3. In an air-powered system, close the pump air regulator, and close the bleed-type master air valve (required in your system).
4. Close the fluid shutoff valves from the supply tanks.
5. Hold a metal part of the gun firmly to the side of a grounded metal pail and trigger the gun to relieve fluid pressure.
6. Open the fluid drain valve (required in your system), having a container ready to catch the drainage. Keep hands away from the end of the drain valve when opening it.
7. Leave the drain valve open until you are ready to use the system again.
8. *For Models 238983, 238984, 238985, 238986, 238987, 238988, 218509, and 220157:* To relieve the gas charge pressure in the surge tank, remove the cap on the charge valve (6), and press down on the valve stem until all pressure is relieved.

   NOTE: Relieving all gas pressure takes several minutes.

   For Model 233736: Back out the plug (11) to relieve air pressure in the surge tank.

Operation

Models 238983, 238984, 238985, 238986, 238987, 238988, 218509, and 220157

⚠ WARNING

- **Always** follow the **Pressure Relief Procedure** on page 9 before you remove the surge tank for any reason.
- Tighten all fluid connections securely before each use.
- **Never** try to stop or deflect leaks with your hand or body.
- **Be sure** the drain valve connected to the surge tank is closed before you start the system.
- **Always** keep hands away from the end of the drain valve when opening it.

NOTE: Always re-torque all of the M12 cap screws and hex nuts using a star-pattern sequence before you charge or operate the surge tank to ensure against fluid or gas leakage. For torque specifications for your Model No., see the **Parts Drawings** on pages 17, 18, and 19.

Charging the Tank

1. The fluid line pressure **must be at zero** before you charge the tank. Pressure in the fluid line prevents the tank from accepting a full charge.

2. Remove the relief valve cap and the tank charge valve cap from the tank charge valve. See Fig. 5.

⚠ WARNING

To reduce the risk of fire or explosion, which could result in serious injury and property damage, **always** use an inert gas, such as nitrogen or compressed air, to charge the tank. **Never** use pure oxygen.

NOTE: Do not install a continuously fed gas charge supply to the surge tank. Doing so will adversely affect the surge tank performance.

3. Up to a charging pressure of 120 psi (0.84 MPa, 8.4 bar) compressed air or bottled nitrogen may be used. For higher pressures, use only nitrogen. **For optimum performance, charge the tank to 2/3 of the anticipated fluid line operating pressure** (see table below). This pressure allows the tank diaphragm to store enough energy for efficient operation. Charging takes several minutes.

FLUID LINE PRESSURE	TANK CHARGE PRESSURE
600 psi (4.2 MPa, 41 bar)	400 psi (2.8 MPa, 28 bar)
500 psi (3.5 MPa, 35 bar)	334 psi (2.2 MPa, 22 bar)
400 psi (2.8 MPa, 28 bar)	268 psi (1.8 MPa, 18 bar)
300 psi (2.1 MPa, 21 bar)	200 psi (1.4 MPa, 14 bar)
200 psi (1.4 MPa, 14 bar)	134 psi (0.9 MPa, 9 bar)
100 psi (0.7 MPa, 7 bar)	67 psi (0.5 MPa, 5 bar)

⚠ CAUTION

The maximum working pressure for surge tank Models 238983, 238984, and 238985 is 300 psi (2.1 MPa, 21 bar). For these Models, do not exceed this fluid line pressure or the associated charge pressure as shown in the table above.

4. Replace the two caps hand-tight.

Relieving Gas Pressure in the Tank

- This tank has a pressure relief valve that automatically relieves gas pressure (only) in the tank if it overpressurizes while charging.

- To manually relieve gas pressure in the tank, remove the cap from the charge valve (6). Press down the stem of the valve until all gas pressure is relieved.

NOTE: Relieving all gas pressure takes several minutes.

Flushing Procedure

For the best flushing results, alternate the gas charge pressure between 2/3 of the fluid pressure (normal operating condition) and zero pressure. This allows the flushing solvent to reach all areas of the fluid containing vessel.

Operation

Models 238983, 238984, 238985, 238986, 238987, 238988, 218509, and 220157

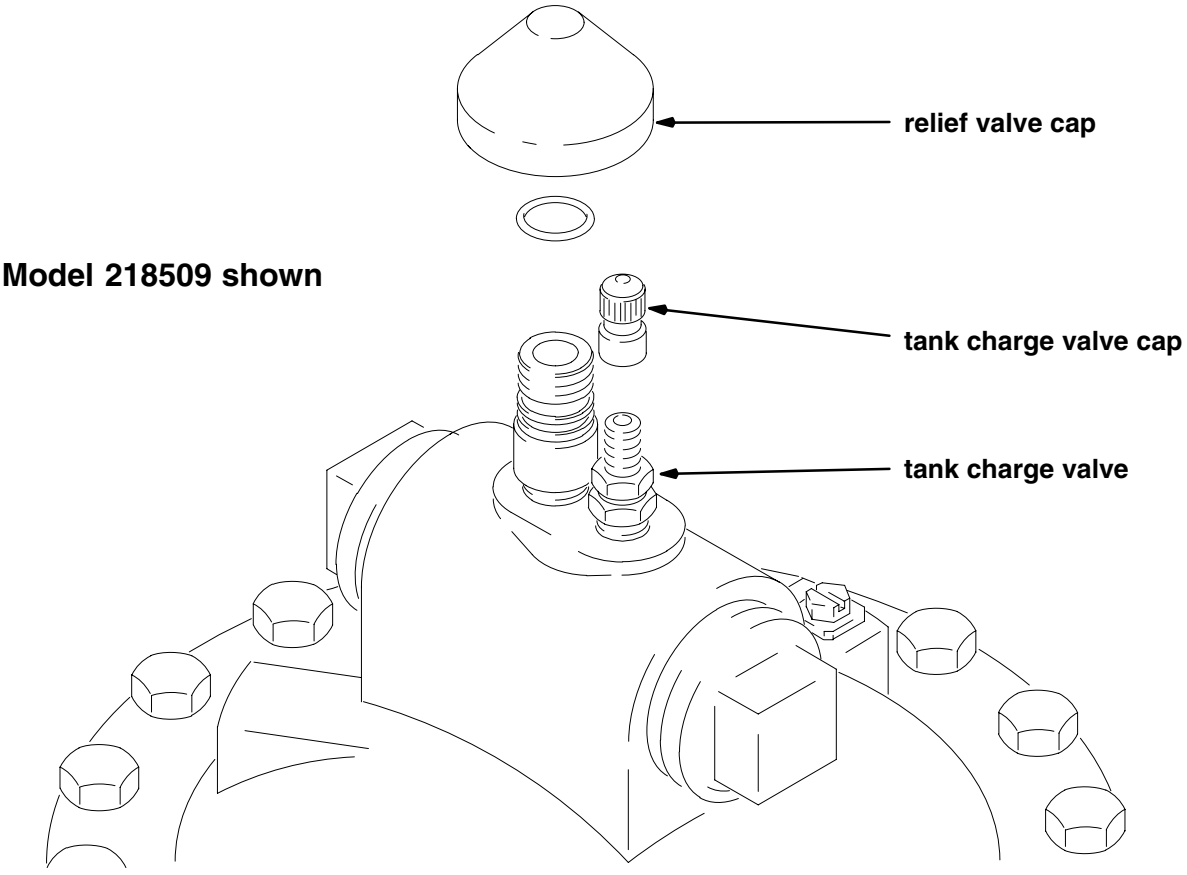


Fig. 5

Operation

Model 233736

⚠ WARNING

- **Always** follow the **Pressure Relief Procedure** on page 9 before you remove the surge tank for any reason.
- Tighten all fluid connections securely before each use.
- **Never** try to stop or deflect leaks with your hand or body.

NOTE: Always re-torque all of the cap screws using a star-pattern sequence before you charge or operate the surge tank to ensure against fluid or air leakage. For torque specifications, see the **Parts Drawing** on page 20.

Charging the Tank with Air

The fluid line pressure **must be at zero** before you charge the tank. Pressure in the fluid line prevents the tank from accepting a full charge.

1. See Fig. 4 on page 8. Close the fluid valve (T). Open the priming valve (R).

2. Open the air valve (N) and set the air regulator (M) to the desired pressure. When the tank is charged with air, close the air valve (N) to prevent air from escaping when fluid is introduced.

   For the best results, set the air pressure to 15 psi (0.1 MPa, 1 bar) below the fluid pressure. Do not exceed the maximum air pressure of 218 psi (1.5 MPa, 15 bar). For fluid pressures of 232 psi (1.6 MPa, 16 bar) and above, set the air pressure to 218 psi (1.5 MPa, 15 bar).

⚠ WARNING

To reduce the risk of fire or explosion, which could result in serious injury and property damage, **always** use compressed air to charge the tank. **Never** use pure oxygen.

Relieving Air Pressure in the Tank

To manually relieve air pressure in the tank, back out the plug (11).

Fill the Tank with Fluid

1. Charge the surge tank with air, as described at left.
2. Open the fluid valve (T). Ensure that the priming valve (R) is open.
3. Start the pump and slowly increase the fluid pressure. When fluid flows from the priming valve, close the valve. The surge tank is ready for use.

⚠ CAUTION

The maximum working pressure for Model 233736 is 360 psi (2.5 MPa, 25 bar). Do not exceed this fluid line pressure.

Flush Before First Use

The surge tank is tested with oil in production. Oil residue remains in the tank to protect it from corrosion. Before using, flush the tank thoroughly with a compatible solvent.

Troubleshooting

⚠ WARNING

To reduce the risk of serious injury, including splashing fluid in the eyes or on the skin, always follow the **Pressure Relief Procedure** on page 9 before you check or service the surge tank or remove the surge tank from the system.

⚠ CAUTION

If you replace the diaphragm, do not attempt to make a new one yourself. Use only genuine Graco parts. Other materials may not stand up to the pressures developed in the tank or to the fluid being pumped. A ruptured diaphragm will release gas into the paint line.

Problem	Cause	Solution
Surge tank will not accept a gas charge.	Plugged restrictor in charge valve (not applicable for Model 233736)	The restrictor is a safety device that prevents overpressurization during charging of the tank. Clean or replace the restrictor bushing: Ref. No. 25 on page 17. Ref. No. 25 on page 18. Ref. No. 13 on page 20.
Poor pulsation reduction.	Incorrect gas charge pressure	Charge the surge tank to recommended air pressure (see **Operation** section).
	Surge tank undersized for application	Reduce working fluid pressure and/or flow rate.
		Install a larger surge tank model.
		Install a surge regulator (SR200)
	Extended pump change-over time due to worn or held open check valves	Repair the piston pump.
Surge tank gas charge bleeds off.	Ruptured diaphragm	Replace diaphragm.
	Relaxed diaphragm seal	Check flange bolt torques. Re-torque as necessary. See **Parts Drawings** for torque specifications.
	Damaged diaphragm seal	Replace.
	Leaking charge valve or relief valve	Replace charge valve or relief valve.

Service

(Models 218509 and 220157)

Installing Diaphragm and Seal Repair Kit

Diaphragm and Seal Repair Kits are available and can be ordered separately as follows:

- Kit 218799, for Model 218509 surge tank
- Kit 234118, for Model 220157 surge tank

⚠ WARNING

Follow the **Pressure Relief Procedure** on page 9 before you check or service the surge tank or remove the surge tank from the system. All fluid and gas charge pressure must be relieved completely before you attempt any service.

*See the **Parts Drawings** on pages 17 and 18.*

Disassembly

1. To manually relieve gas pressure in the tank, remove the relief valve cap (27) and the cap from the charge valve (6). Press down the valve stem until all gas pressure is relieved.

   NOTE: Relieving all gas pressure takes several minutes.

2. Disassemble the surge tank by removing the M12 cap screws (2), lock washers (3), and hex nuts (4).

   NOTE: Model 220157 does not contain lockwashers (3) or hex nuts (4).

3. Separate the air section (7) from the fluid section (8). Be careful that you do not damage the machined flange surfaces or components attached to either housing.

4. Remove and discard the diaphragm (1a) and the two o-rings (1b).

Reassembly

1. Carefully and thoroughly clean all housing flange and o-ring sealing surfaces. Clean and dry an area at least 12 mm (0.5 in.) inside the o-ring diameter on the upper air housing (7) for application of the special gasket joint sealant (38).

2. Install the new o-rings (1b), and lay the diaphragm (1a) in place on the lower fluid housing (8).

3. Remove the printed release paper from the gasket joint sealant (38) adhesive strip.

   NOTE: Be careful not to remove the adhesive with the release paper. Check to be sure that the adhesive stays on the joint sealant. If the adhesive sticks to the release paper and begins to lift off the joint sealant, stop and trim to a new length, or start from the opposite end and try again.

4. Place the gasket joint sealant (38) on the upper air housing (7) within 3 mm (1/8 in.) of the internal diameter of the o-ring groove as follows. Be careful that you do not twist or damage the joint sealant during installation.

   a. Begin and finish the sealant ends directly inward from a bolt hole. See **Detail** in **Parts Drawings**.

   b. Overlap the ends of the sealant by at least 10 mm (3/8 in.) as shown. Point the ends inward.

   c. Trim off excess length of joint sealant as necessary.

5. Reassemble the housings carefully, making sure the joint sealant remains in place.

6. Torque the M12 cap screws (2) using a star pattern sequence, in three successive steps, to a final torque of 63 to 73 N-m (46 to 54 ft-lb).

7. Follow the instructions for **Charging the Tank** on page 10, and see **Operation** on page 9 to return the surge tank to service.

Service

(Models 238983, 238984, 238985, 238986, 238987, 238988)

Installing Diaphragm Repair Kit

Diaphragm and Seal Repair Kit 248079 is available and can be ordered separately.

⚠ WARNING

Follow the **Pressure Relief Procedure** on page 9 before you check or service the surge tank or remove the surge tank from the system. All fluid and gas charge pressure must be relieved completely before you attempt any service.

*See the **Parts Drawing** on page 19.*

Disassembly

1. To manually relieve gas pressure in the tank, remove the relief valve cap (17) and the cap from the charge valve (15). Press down the valve stem until all gas pressure is relieved.

   NOTE: Relieving all gas pressure takes several minutes.

2. Disassemble the surge tank by removing the M12 cap screws (8), plain washers (11), lock washers (10), and hex nuts (9).

3. Separate the air housing (2) from the fluid housing (1). Be careful that you do not damage the machined flange surfaces or components attached to either housing.

4. Remove and discard the diaphragms (6 and 7).

Reassembly

1. Carefully and thoroughly clean all housing flange and diaphragm bead sealing surfaces.

2. Lay the diaphragm (7a,b) in place on the lower fluid housing (1) with the center contour (the convex side) facing upward.

3. Lay the cream-colored TPE backing diaphragm (6) over the diaphragm (7a, b). The diaphragms should fit closely together.

4. Reassemble the air housing (2) and the fluid housing (1) carefully. Make sure the diaphragms remain in the grooves and are not pinched.

5. Replace the flange hardware with the capscrews, nuts, and washers that are provided with the Diaphragm Repair Kit.

6. Torque the M12 cap screws (8) using a star-pattern sequence in two successive steps to a final torque of 68 to 81 N-m (50 to 60 ft-lb).

7. Follow the **Charging the Tank** instructions on page 10. See the rest of the **Operation** section on page 10 to return the surge tank to service.

Service

(Model 233736)

Diaphragm Repair

⚠ WARNING

Follow the **Pressure Relief Procedure** on page 9 before you check or service the surge tank or remove the surge tank from the system. All fluid and gas charge pressure must be relieved completely before you attempt any service.

*See the **Parts Drawing** on page 20.*

Disassembly

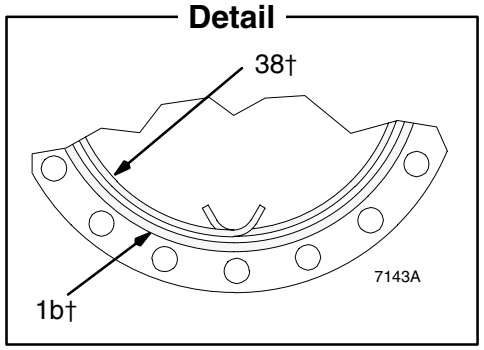
1. To manually relieve air pressure in the tank, back out the plug (11).
2. Disassemble the surge tank by removing the cap screws (8).
3. Separate the air housing (2) from the fluid housing (1). Be careful that you do not damage the machined flange surfaces or components attached to either housing.
4. Remove the screw (10) and diaphragm plates (5, 6). Discard the diaphragm (7).

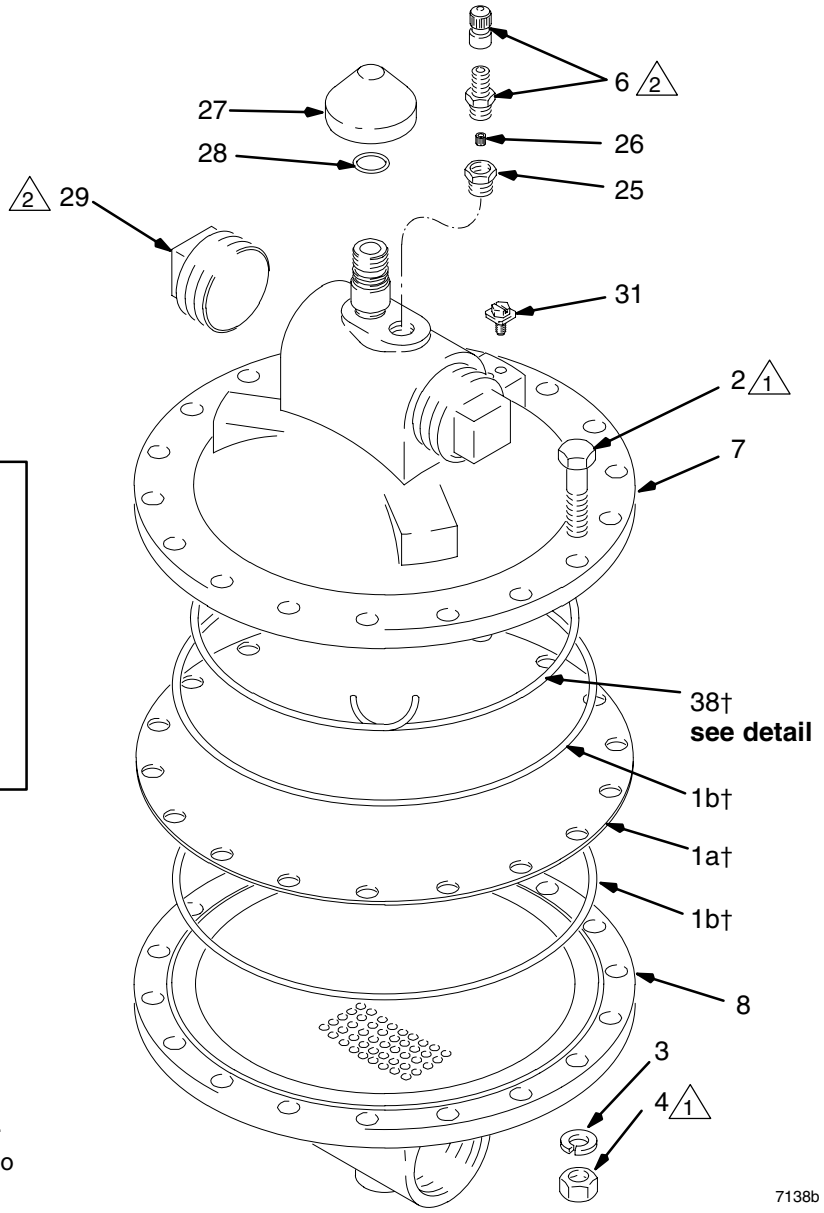
Reassembly

1. Carefully and thoroughly clean all housing flange and diaphragm sealing surfaces.
2. Apply thread sealant to the screw (10). Assemble the air side plate (6), diaphragm (7), fluid side plate (5), and screw (10) as shown in the parts drawing. Torque the screw to 2 to 3 N-m (1.5 to 2.2 ft-lb). Lay the diaphragm (7) in the lower fluid housing (1) with the smaller air side plate facing upward.
3. Reassemble the air housing (2) and the fluid housing (1) carefully. Make sure the diaphragm is not pinched.
4. Replace the capscrews (8) loosely, then torque the screws (8) to 18 to 22 N-m (13 to 16 ft-lb), using a star-pattern sequence.
5. Follow the **Charging the Tank with Air** instructions on page 12. See the rest of the **Operation** section on page 12 to return the surge tank to service.

Parts

Model 218509, Series E
carbon steel,
2 npt(f) inlet/outlet





1 Torque to 63 to 73 N-m (46 to 54 ft-lb).

2 Apply thread sealant and thread tape to pipe threads before reassembling.

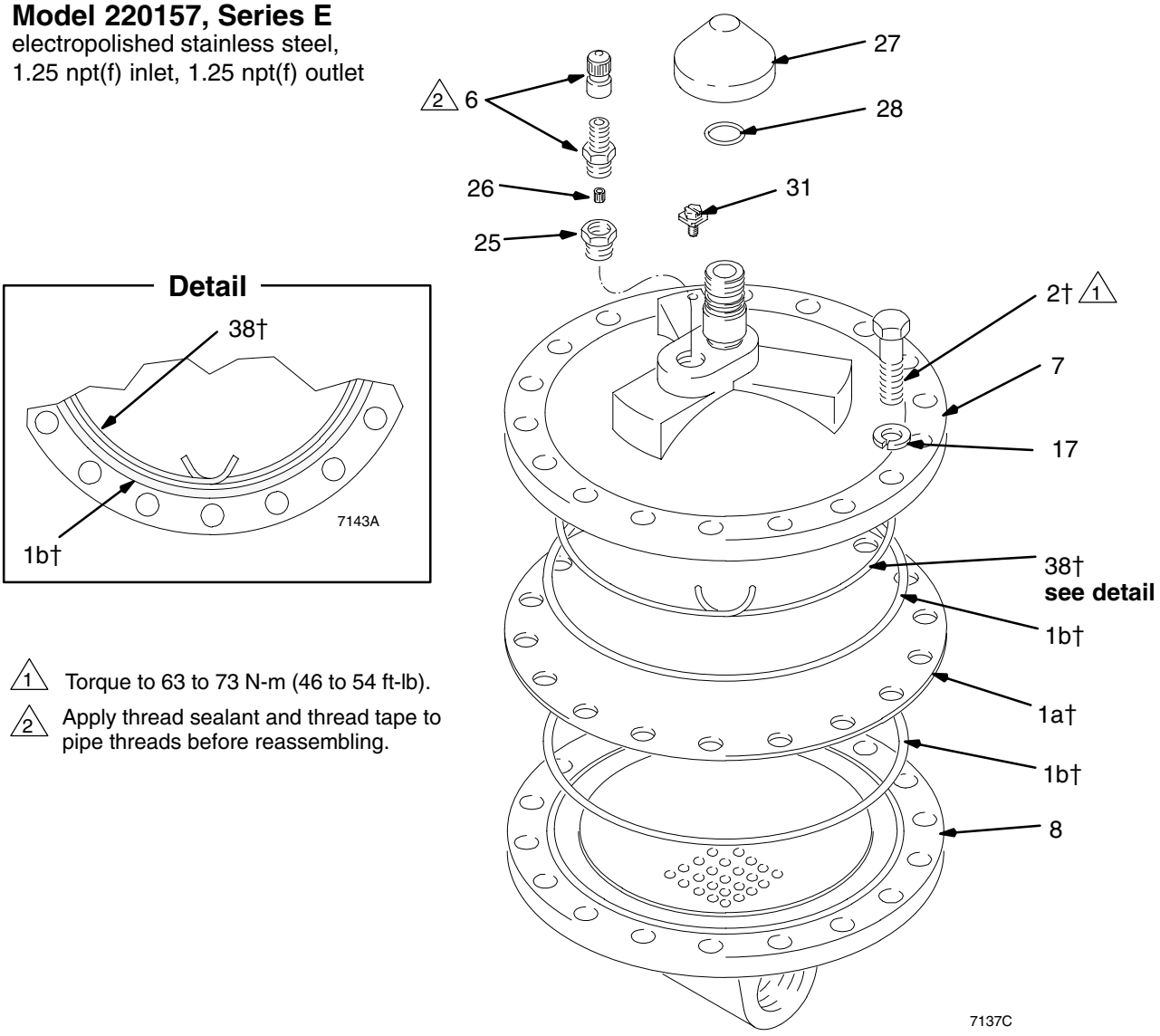
Ref No.	Part No.	Description	Qty.
1	218799	REPAIR KIT, surge tank; includes items 1a, 1b, and 38	1
1a†		. DIAPHRAGM	1
1b†		. O–RING	2
2	107596	. CAPSCREW, hex hd; M12 x 50	24
3	107541	. LOCKWASHER, spring	24
4	107539	. NUT, hex; M12	24
6	104031	VALVE, charge, tank	1
7	180667	HOUSING, diaphragm	1
8	180557	HOUSING, diaphragm *(Model 218509 only)*	1
25	180969	BUSHING, air valve	1
26	108147	ELEMENT, filter	1
27	180942	CAP, relief valve	1
28	108519	O–RING; fluoroelastomer	1
29	102042	PLUG, pipe	2
31	116343	SCREW, grounding	1
33*	181068	TAG, warning *(not shown)*	1
38†	192258	GASKET JOINT SEALANT	1

† These parts are available in Diaphragm and Seal Repair Kit 218799, which can be ordered separately.

* Extra warning tags are available at no charge.

Parts

Model 220157, Series E
electropolished stainless steel,
1.25 npt(f) inlet, 1.25 npt(f) outlet



1 Torque to 63 to 73 N-m (46 to 54 ft-lb).

2 Apply thread sealant and thread tape to pipe threads before reassembling.

Ref No.	Part No.	Description	Qty.
1	234118	REPAIR KIT, surge tank; includes items 1a, 1b, 2, and 38	1
1a†		. DIAPHRAGM	1
1b†		. O–RING	2
2†	117638	. CAPSCREW, hex hd; M12 x 50	18
6	104031	VALVE, charge, tank	1
7	181408	HOUSING, diaphragm	1
8	181410	HOUSING, diaphragm	1
17	107541	WASHER, lock, spring	18
25	180969	BUSHING, air valve	1
26	108147	ELEMENT, filter	1
27	180942	CAP, relief valve	1
28	108519	O–RING; fluoroelastomer	1
31	116343	SCREW, grounding	1
33*	181068	TAG, warning *(not shown)*	1
38†	192258	GASKET JOINT SEALANT	1

† These parts are available in Diaphragm and Seal Repair Kit 234118, which can be ordered separately.

* Extra warning tags are available at no charge.

Parts

Models

238983, 238986 Series C
electropolished stainless steel, 2 npt(f) inlet/outlet

238984, 238987 Series C
electropolished stainless steel, 2-in. sanitary inlet/outlet

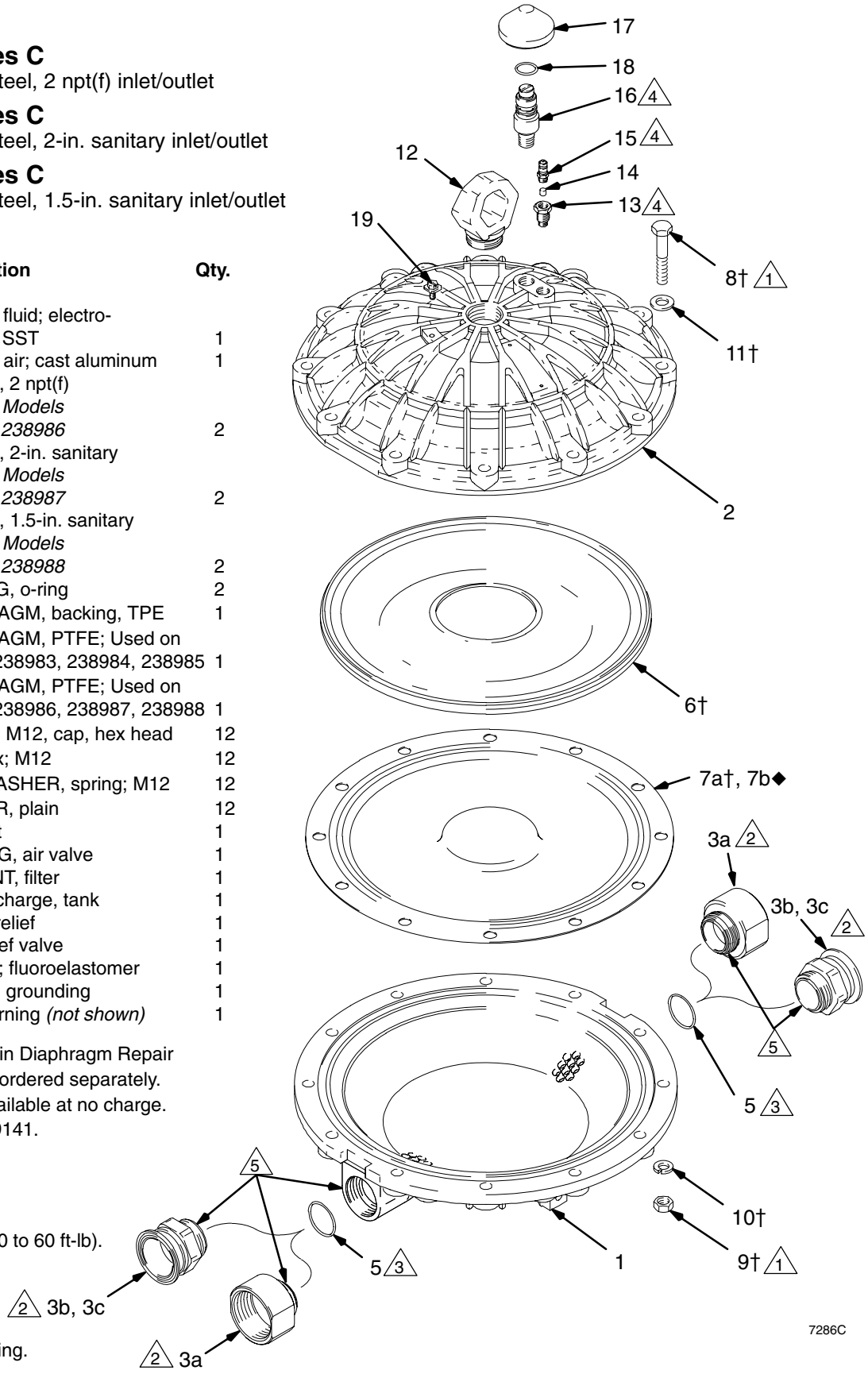
238985, 238988 Series C
electropolished stainless steel, 1.5-in. sanitary inlet/outlet

Ref No.	Part No.	Description	Qty.
1	15D038	COVER, fluid; electro-polished SST	1
2	191768	COVER, air; cast aluminum	1
3a	191771	FITTING, 2 npt(f) *Used on Models 238983, 238986*	2
3b	187004	FITTING, 2-in. sanitary *Used on Models 238984, 238987*	2
3c	188286	FITTING, 1.5-in. sanitary *Used on Models 238985, 238988*	2
5	107078	PACKING, o-ring	2
6†◆	191407	DIAPHRAGM, backing, TPE	1
7a†	118357	DIAPHRAGM, PTFE; Used on Models 238983, 238984, 238985	1
7b◆	15F232	DIAPHRAGM, PTFE; Used on Models 238986, 238987, 238988	1
8†◆	15W044	SCREW, M12, cap, hex head	12
9†◆	15W043	NUT, hex; M12	12
10†◆	107541	LOCKWASHER, spring; M12	12
11†◆	109570	WASHER, plain	12
12	180952	RING, lift	1
13	180969	BUSHING, air valve	1
14	108147	ELEMENT, filter	1
15	104031	VALVE, charge, tank	1
16	238876	VALVE, relief	1
17	180942	CAP, relief valve	1
18	108519	O–RING; fluoroelastomer	1
19	116343	SCREW, grounding	1
21*	181068	TAG, warning *(not shown)*	1

† These parts are available in Diaphragm Repair Kit 248079, which can be ordered separately.

* Extra warning tags are available at no charge.

◆ Included in repair kit 249141.



1 Torque to 68 to 81 N-m (50 to 60 ft-lb).

2 Torque to 136 to 149 N-m (100 to 110 ft-lb).

3 Apply lubricant to o-ring surface before reassembling.

4 Apply thread sealant and thread tape to pipe threads before reassembling.

5 Non-standard thread. Use Graco-approved fittings only.

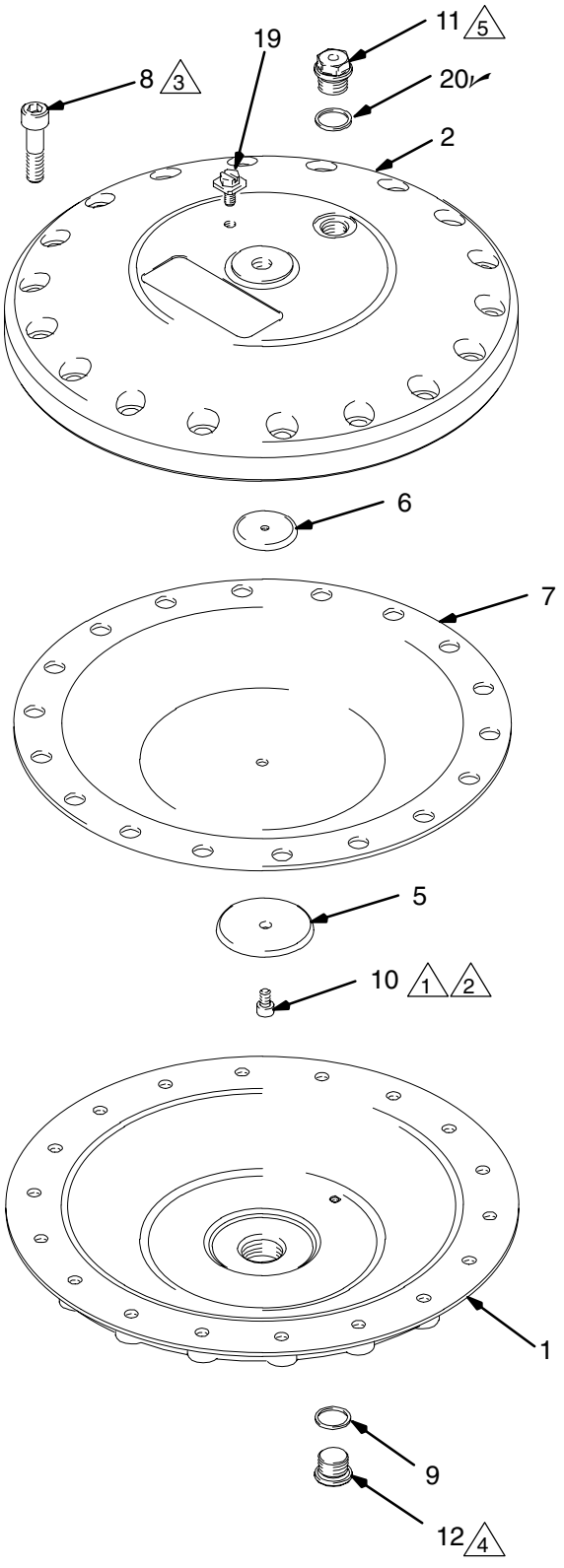
Parts

Model 233736, Series A

stainless steel, 1/4 bspp(f) air port, 3/4 bspp(f) fluid port

Ref No.	Part No.	Description	Qty.
1	198776	COVER, fluid;SST	1
2	198775	COVER, air; cast aluminum	1
5	198779	PLATE, diaphragm, fluid side	1
6	198778	PLATE, diaphragm, air side	1
7	198777	DIAPHRAGM, PTFE	1
8	117033	SCREW, M10, cap, socket head	18
9	116898	WASHER	1
10	116899	SCREW, cap, socket head	1
11	116901	PLUG, hex head	1
12	116902	PLUG, socket head	1
19	116343	SCREW, grounding	1
20✓	15F749	WASHER, seal	1

✓ Keep this part on hand to reduce down time.



△1 Apply thread sealant.

△2 Torque to 2 to 3 N-m (1.5 to 2.2 ft-lb).

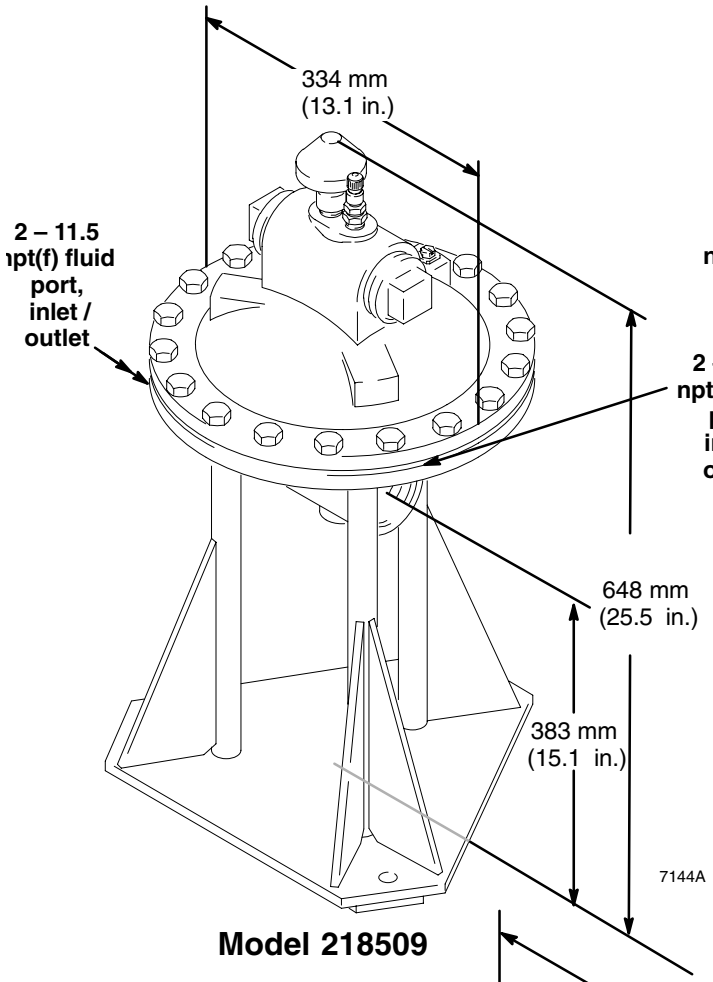
△3 Torque to 18 to 22 N-m (13 to 16 ft-lb).

△4 Torque to 47 to 55 N-m (35 to 40 ft-lb).

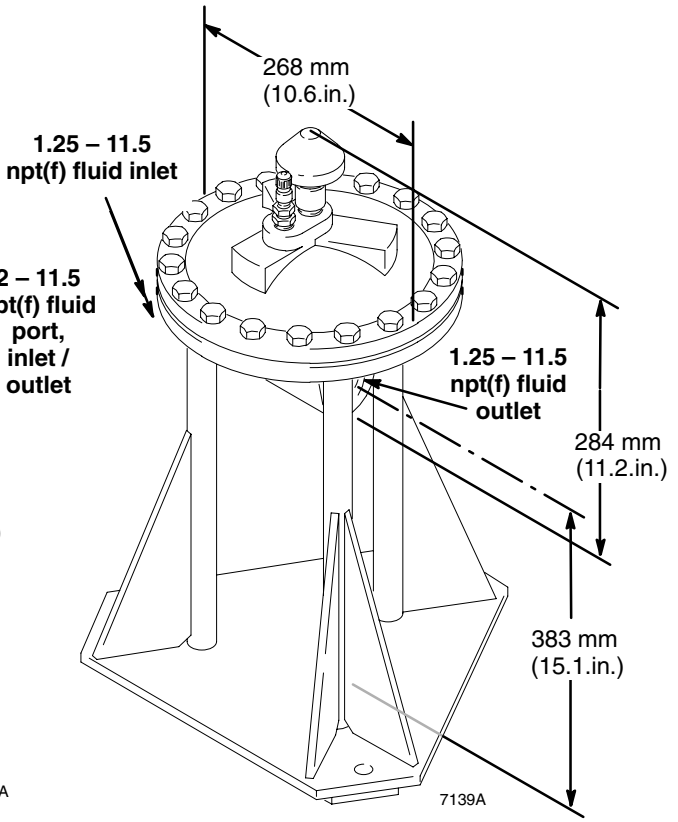
△5 Torque to 43.4 N-m (32 ft-lb).

TI1899B

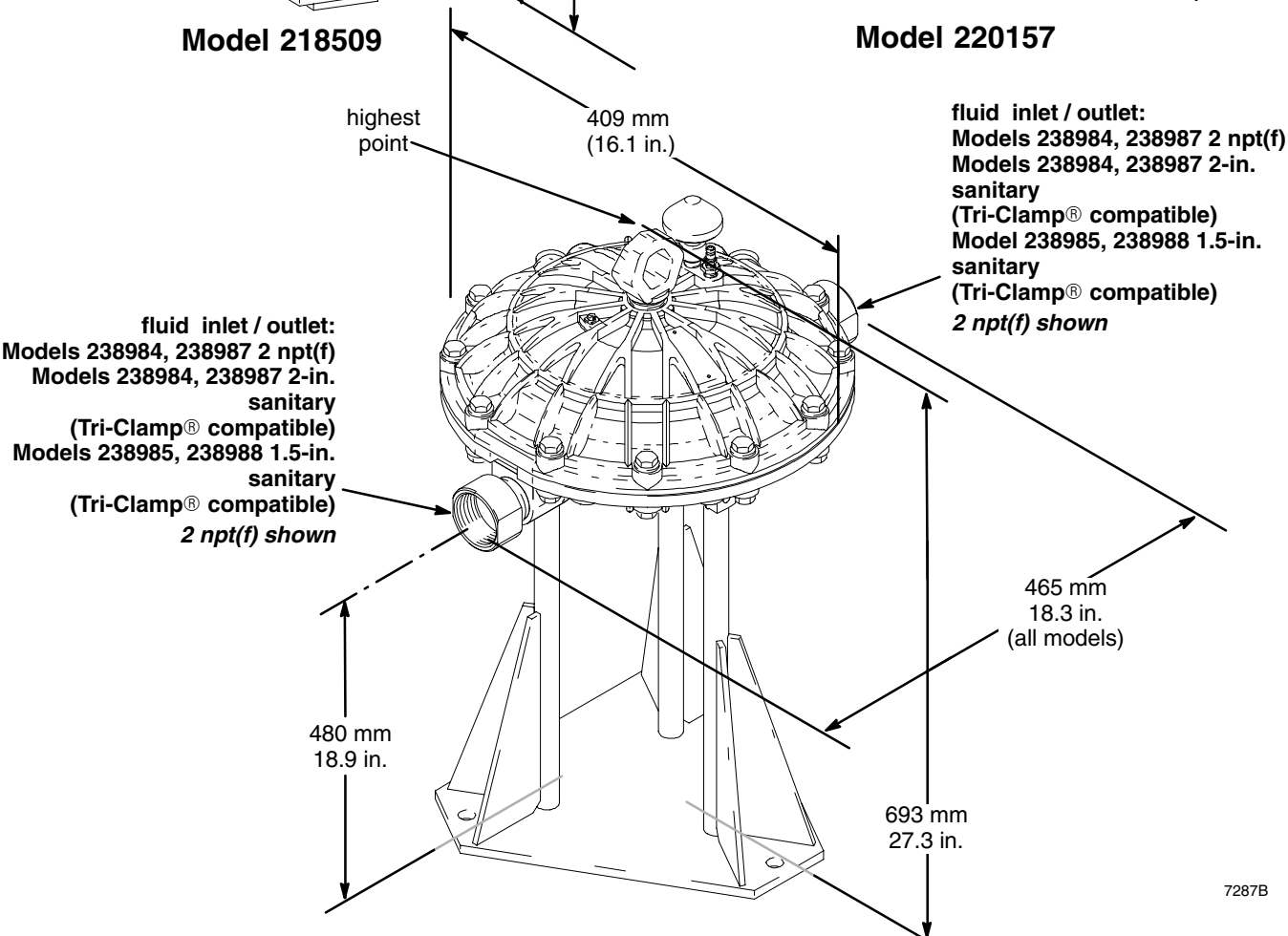
Dimensional Drawings



Model 218509

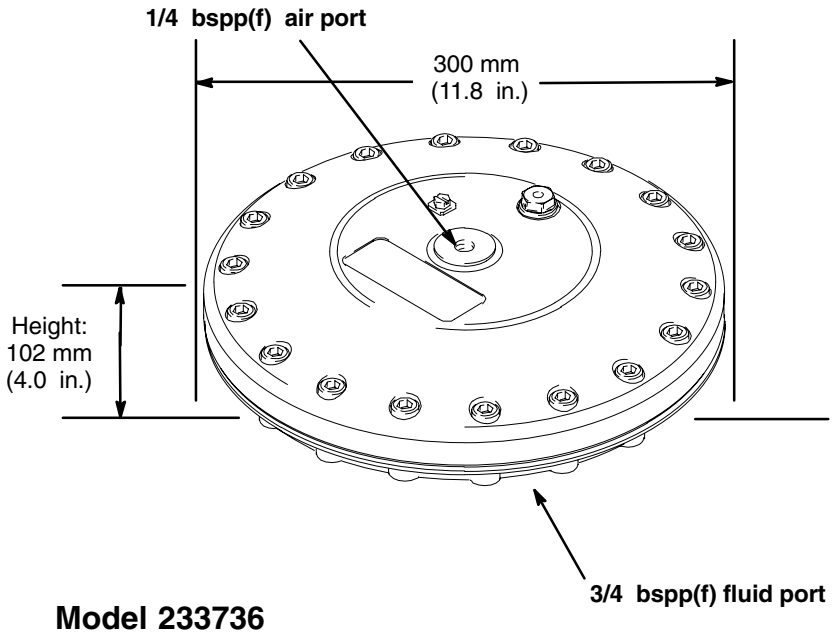


Model 220157



Models 238983, 238984, 238985, 238986, 238987, 238988

Dimensional Drawings

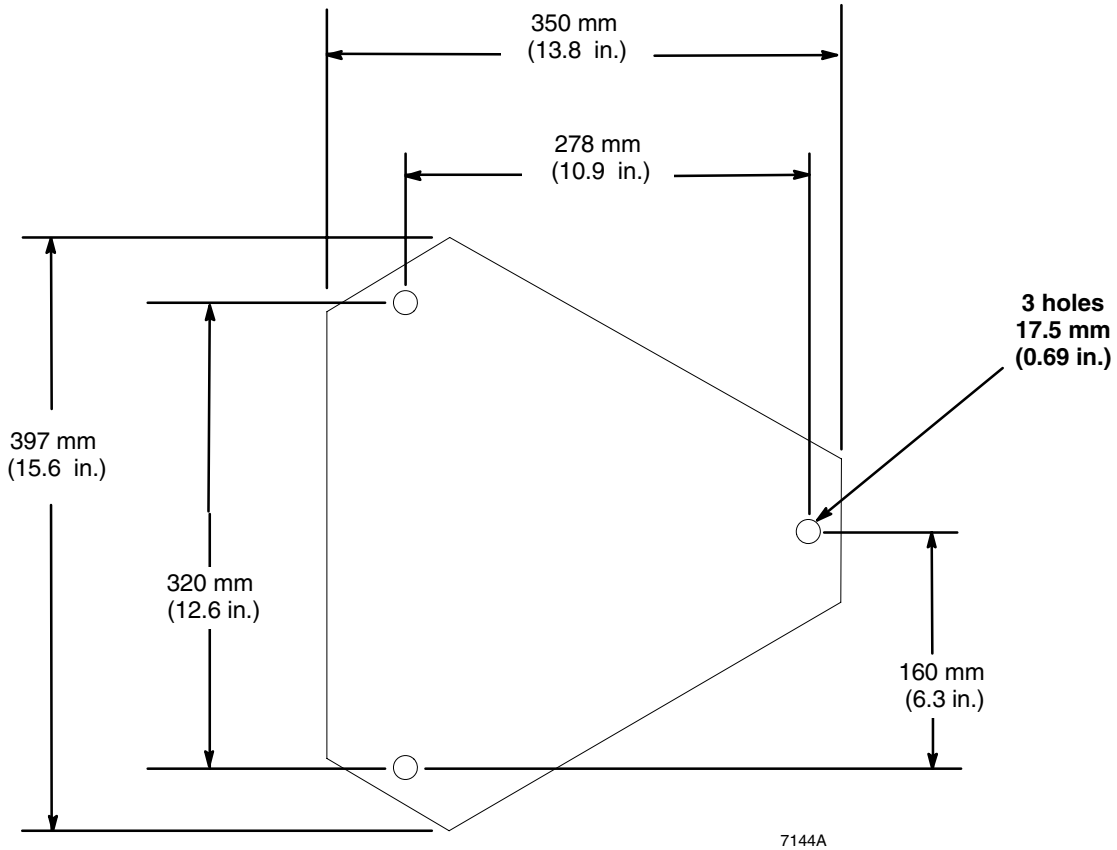


Model 233736

TI1898B

Stand Mounting Hole Layout

(Stand is not used with Model 233736)



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Technical Data

Category	Data
Maximum fluid working pressure	*Models 238983, 238984, 238985, 238986, 238987, 238988:* 300 psi (2.1 MPa, 21 bar) *Model 233736:* 360 psi (2.5 MPa, 25 bar) *Models 218509, 220157:* 600 psi (4.2 MPa, 42 bar)
Maximum gas charge pressure (maximum air inlet pressure for Model 233736)	*Models 238983, 238984, 238985, 238986, 238987, 238988:* 300 psi (2.1 MPa, 21 bar) *Model 233736 (air inlet pressure):* 218 psi (1.5 MPa, 15 bar) *Models 218509, 220157:* 600 psi (4.2 MPa, 42 bar)
Maximum flow rate*	*Models 238983, 238984, 238985,238986, 238987, 238988 218509:* 76 lpm (20 gpm) *Model 233736:* tank volume is 1.5 liters (0.4 gal.); fluid does not flow through tank *Model: 220157:* 57 lpm (15 gpm)
Maximum operating temperature	*Model 233736:* 80° C (176° F) *All other models:* 50° C (120° F)
Wetted parts	*Models 238983, 238984, 238985, 238986, 238987, 238988:* 304 & 316 stainless steel, PTFE. *Model 233736:* stainless steel, PTFE *Model 218509, 220157:* carbon steel, electroless nickel-plated steel, UHMW polyethylene, fluoroelastomer, PTFE *Model 220157:* 304 and 17–4 PH stainless steel, UHMW polyethylene, fluoroelastomer, PTFE, tungsten carbide

***** Maximum flow rates are recommended maximums for peak performance. Exceeding these values reduces the surge tank's ability to dampen pulsation.

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Canadian Registration Number (CRN)

Model	Alberta	Ontario
218509	0C04874.52	0C4874.5R1
220157	0C04874.52	0C4874.5R1

Graco Standard Warranty

Graco warrants all equipment manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

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This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

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